不管你布线、穿孔、剪切、切断还是划V型线，分板是电子产品组装中必须考虑的程序。不管使用什么方法，都必须对印刷电路板施加某种力。力的适当施加可保证过程安全、可重复、无缺陷。每种分板的方法都对印刷电路板及元件有不同的影响。分板时施加的力必须测量、分析并在某些情况下适当控制。预压分板被证明为一种精确、可重复、轻柔、量高而独特的方法。

Depaneling Requires a Closer Look

Michael Stanard

Press-type depaneling can be an accurate and gentle singulation method.

Depaneling is a process that you cannot avoid if you are involved in the assembly of printed circuit boards (PCBs). It is found, in one form or another, in just about every electronics manufacturing environment. Whether you route, punch, snip, snap or V-score, it is a process that must be considered or manufacturing efficiency and product quality may suffer.

Regardless of the depaneling method used, some force must be applied to the PCB array. The proper application of that force will ensure a safe, repeatable, defect-free process. Every depaneling method has a different effect on the PCB and its components. The forces applied in each method differ in magnitude, direction, repeatability and duration. Analyzing each method and its effects on the thousands of PCB applications in the industry is beyond the scope of this article. However, what is key is that the forces applied during the depaneling process can be measured, analyzed and, in certain cases, properly controlled.

Determining the Root Cause

In a modern manufacturing environment where surface-mount components are the norm, depaneling methods such as V-scores and various hand-break methods may be risky. Reliably and repeatably controlling the forces required to depanel the PCB is difficult. If a ceramic capacitor is damaged, for example, the defect may then show up as a field failure. These kind of defects can slip right through a functional test.

The root cause of many cracked or damaged components is board flex and, in some extreme cases, shock (acceleration). When these defects arise, the difficult part is finding the root cause and applying a robust solution. Remember that component damage can be caused by many different manufacturing processes—for example, thermal cracking in the solder process, mechanical cracking in the part placement process or even in-circuit test. You must have a full understanding of each process if a robust and lasting solution is to be found.

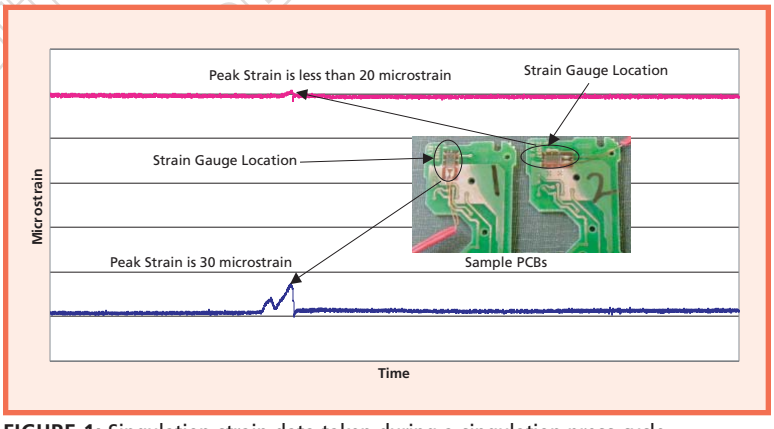

FIGURE 1: Singulation strain data taken during a singulation press cycle.

Strain Measurement

The measurement of strain is a good way to determine what the PCB will experience during any process. Strain is generally defined as bending or deformation as a function of unit length. Using this

definition, strain becomes a dimensionless ratio. When measuring strain, collecting both positive and negative readings is possible. These readings will indicate either tension or compression in the PCB. The strain gauge, when rigidly mounted to the sample PCB, will stretch and compress with that sample. These changes in the PCB and the gauge can be measured easily with the proper equipment.

The procedure is fairly straightforward, although setups and test equipment can vary widely. The most important part of the test is to find a gauge location that will yield useful information. This location can be determined by the customer or through a careful analysis of the sensitive components on the PCB. Once the proper location has been determined, the PCB is prepped for gauge application.

The gauge is then bonded to the PCB with a cyanoacrylate base adhesive. This step is important because the gauge must be rigidly bonded to the PCB surface or the resulting measurements will be inconsistent. The instrumented PCB is then placed on the tool, and the press is cycled. Data are taken throughout the entire press cycle. When the recorded data are displayed graphically, the amount and duration of the strain that the PCB may experience during the press cycle is easily seen (Figure 1).

Each singulation tool will exhibit its own characteristic strain graph that is made up of several components. Each component of the graph reveals how the tool is performing and ways in which it can be improved. Through combined testing and experimentation, changes can be made to the press-type singulation tooling design to reduce average strain to less than 300 micro strain.

To put this number in perspective, most customer specifications state that the strain experienced by the circuit board during the depaneling process, or any process, must be less than 1000 micro strain. Also, studies of the effects of shock or acceleration showed that the time needed to punch a PCB tab is so small, not enough energy is produced during the tab shear to damage components.

Conclusion

Press-type depaneling has been shown to be an accurate, repeatable, gentle, high-volume singulation method. These qualities have come through a thorough understanding of the process and its variables. Press-type singulation has changed with design technology changes in the electronics industry and is especially suited for high-volume depaneling applications. ■

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